

ARCTIC METROLOGY: CASE STUDY FOR AIR TEMPERATURE MEASUREMENTS AT NY-ÅLESUND, SVALBARD

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ABSTRACT

The Arctic plays a crucial role in collecting environmental data due to its sensitivity to climate change and its remote location. The Ny-Ålesund research center, situated in the Norwegian Svalbard Archipelago, serves as a strategic site for conducting such measurements, benefiting from existing infrastructure and relatively accessible conditions.

However, the harsh environment of polar regions can impact sensor performance, as these devices are not designed for extreme conditions. Regular maintenance of these sensors is essential, conducted with metrological rigor to ensure traceability and comparability over time and space with other instruments.

In this communication, we present the results of the calibration campaign carried out by INRiM on air temperature sensors installed on the Ny-Ålesund Climate Change Tower (CCT), managed by CNR-ISP. During this campaign, we corrected temperature measurements across the atmospheric vertical profile from ground level up to 34 m, identifying errors of up to 1 °C. Furthermore, we reduced the absolute measurement uncertainty compared to the manufacturer's specifications and achieved relative uncertainty on the profile to within a few hundredths of a degree Celsius.

Finally, we will also outline future development prospects in this field.

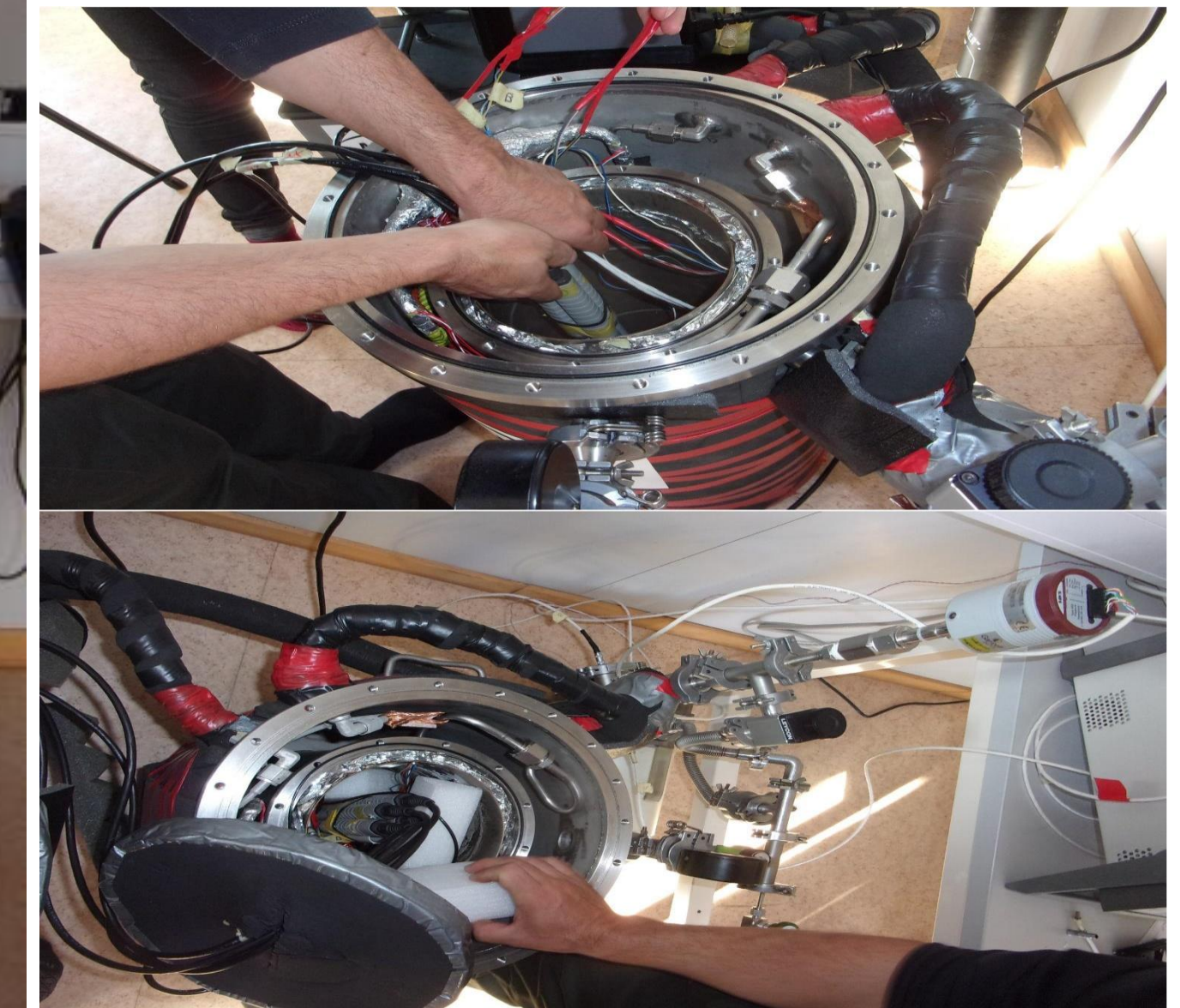


- **Arctic** is one the most sensitive places to climate change, up to 4 times faster than the rest of the planet.
- Arctic is therefore a key place where to perform **environmental measurements**
- **Meteorological instruments** usually are not specifically designed for such harsh environment -> chances of **errors, failures and malfunctions** are high
- **Calibration in laboratory** of these instrument is often **not feasible**

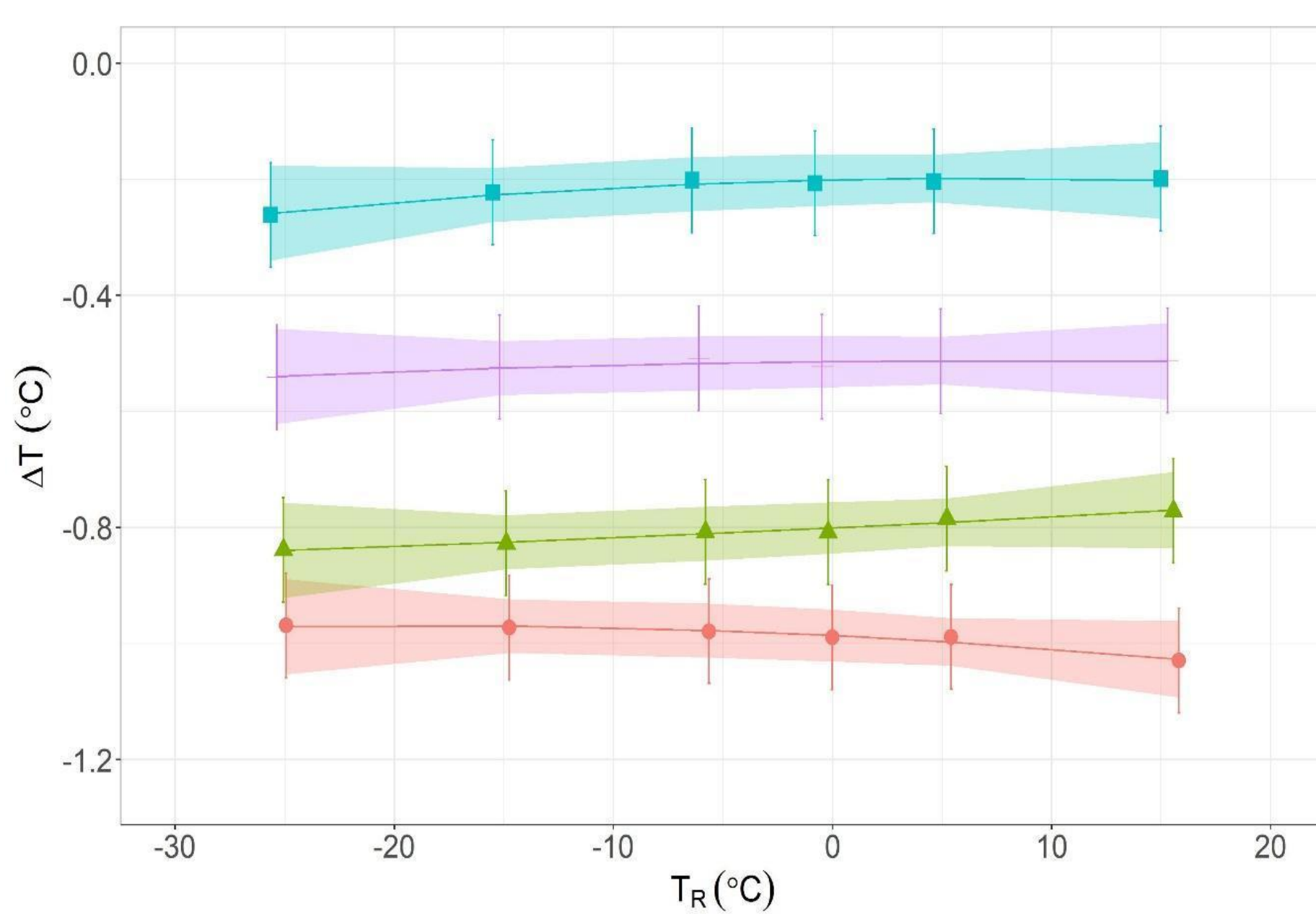


- **Portable climatic chamber EDIE** has been developed and built by INRiM, in order to perform in-situ calibration of sensors in difficult environments, to avoid mechanical shocks due to transportation
- An **in-situ calibration campaign** has been carried for the **air temperature sensors** at the **Climate Change Tower (CCT)** in Ny-Ålesund, Svalbard, managed by CNR-ISP.

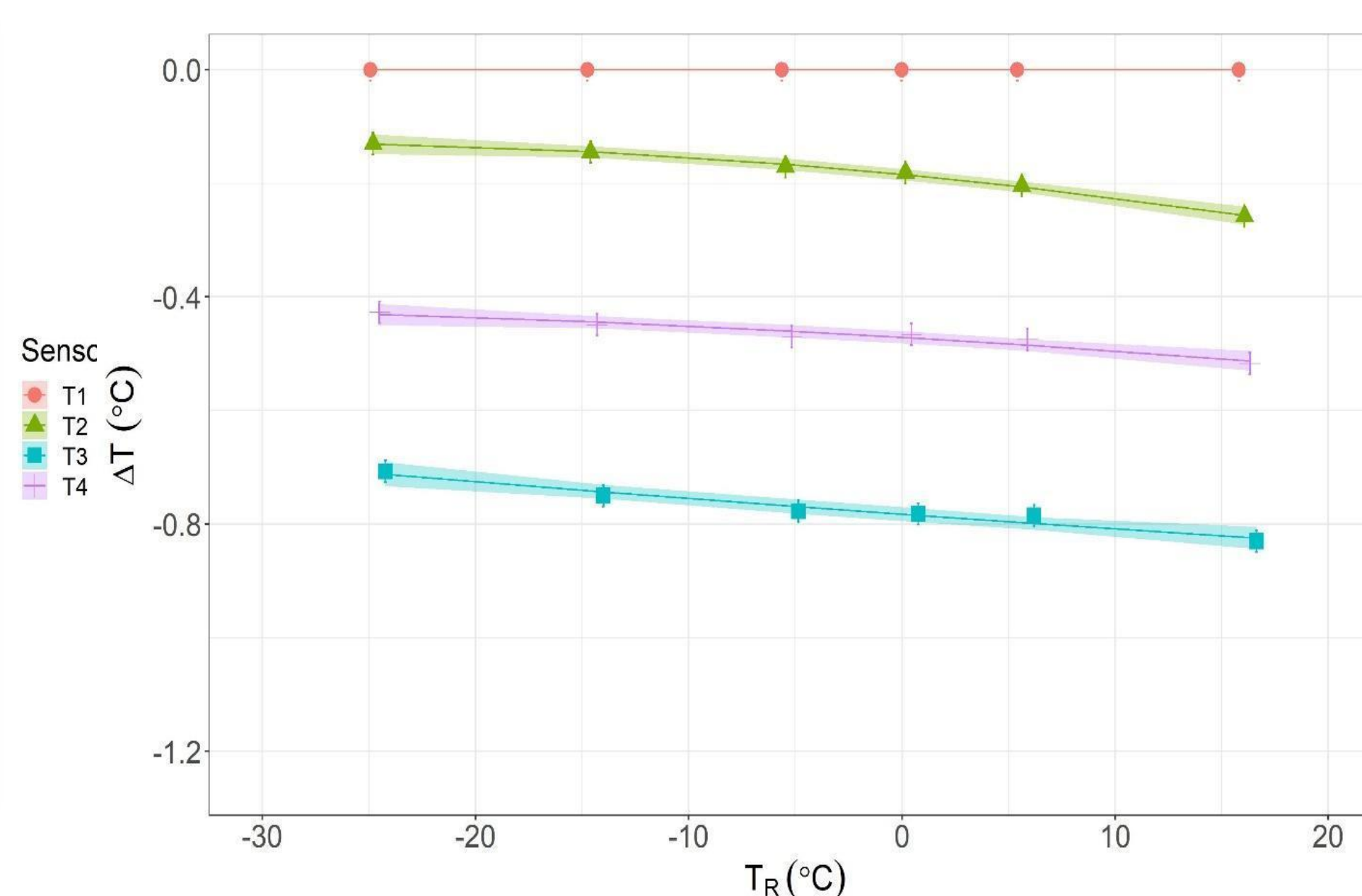
- Results show **large errors** (~1 °C) due to exposure to harsh environment, and **reduced** the manufacturer **uncertainty in half**
- **Relative calibrations** were able to further reduce **uncertainty to few °C**
- **Air temperature profiles** completely **rearranged**



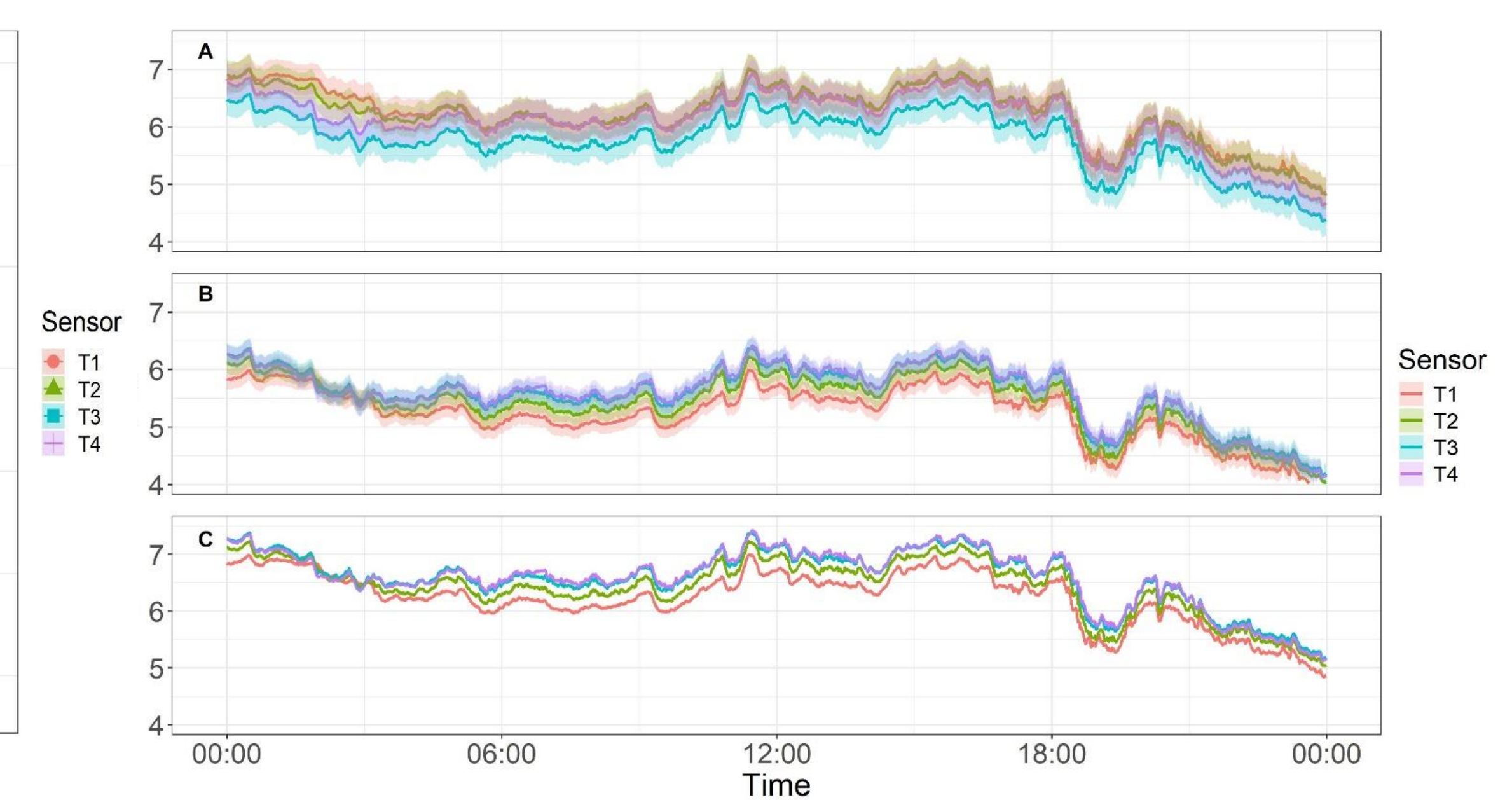
Absolute calibration



Relative calibration



Uncalibrated (A) & calibrated (B,C) profiles



Conclusion: particular care must be put in the maintenance and calibration of sensors in harsh environment, especially for comparison with other stations. **To do:** Repeat calibration to evaluate sensors drift.

Coppa, G., Musacchio, C., Becherini, F., Mazzola, M., Viola, A., & Merlone, A. (2024). On-site calibration of instruments in the Arctic: assessment of temperature records at Climate Change Tower in Ny-Ålesund, Svalbard. *Arctic Science*. <https://doi.org/10.1139/as-2024-0008>